Chapter 4:
Mortality

Mortality

Deaths due to asthma, while not common, are preventable and represent a breakdown in successful disease management. The national data from 2002 show that 4,261 persons died in the United States that year from a primary cause of asthma, while 110 persons in North Carolina died from a primary cause of asthma in that same year. Most recent data from North Carolina shows that in 2005, 116 persons died due to a primary cause of asthma. North Carolina mortality data was obtained from the North Carolina State Center for Health Statistics Detailed Mortality Reports that are published each year.

Since 1999, asthma deaths have been coded under the ICD-10 classification as either J45.x (Asthma) or J46.x (Status Asthmaticus). Prior to 1999, the ICD-9 classification system was in use, and asthma deaths were coded as 493.x. Following the change in the classification system, the National Center for Health Statistics (NCHS) reported a comparability ratio of 0.8938 for the coding of asthma mortality under ICD-10 as compared to ICD-9. That is, about 11% fewer deaths will be coded as indicating that asthma was the underlying cause of death compared to those deaths coded under ICD-9.[4] Mortality rates that are seen in this document prior to 1999 have been adjusted using this comparability ratio.

Asthma as a Primary Cause of Death

Asthma mortality is examined in two ways in this chapter. In the first section, we evaluate asthma as a primary or underlying cause of death. In general terms, these are the cases where one would say asthma is the direct cause of death.

United States and North Carolina

North Carolina asthma mortality rates have been similar to national asthma mortality rates for the past 10 years.

Figure 46. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, All Ages, North Carolina and the United States, 1995 - 2005[1,2,3,4,5]

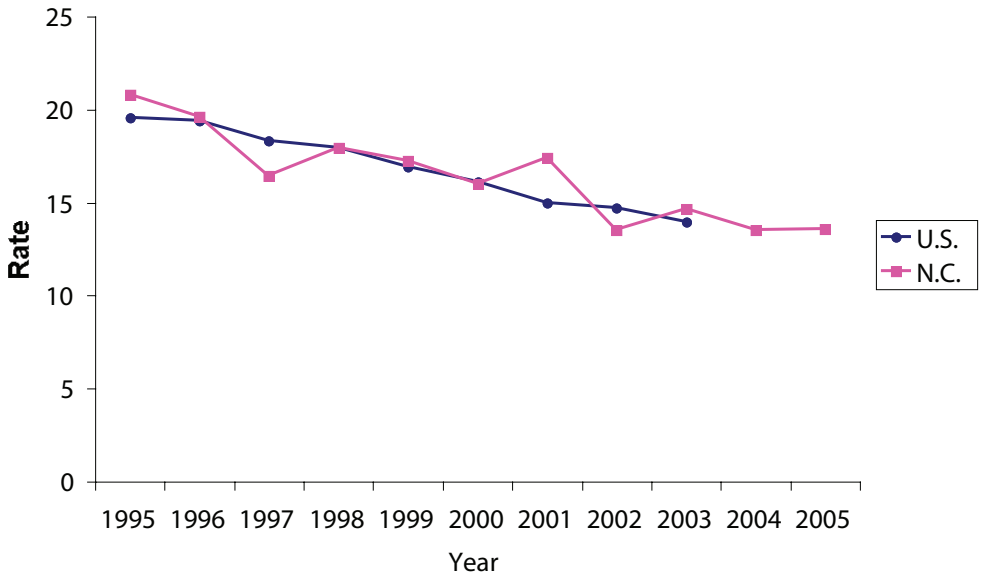

Table 21. Rates (per 1,000,000) and Counts of Deaths Due to Asthma, All Ages, United States and North Carolina, 1995-2004

YEAR	United States Rate (Count)	North Carolina Rate (Count)
1995	19.57 (5,637)	20.81 (180)
1996	19.39 (5,667)	19.59 (174)
1997	18.32 (5,434)	16.44 (150)
1998	17.97 (5,438)	17.92 (168)
1999	16.9 (4,657)	17.25 (132)
2000	16.1 (4,487)	16.01 (125)
2001	15 (4,269)	17.39 (138)
2002	14.78 (4,261)	13.53 (110)
2003	13.94 (4,099)	14.65 (122)
2004	*	13.50 (113)
2005	*	13.57 (116)

* Numbers not available
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]National numbers obtained from CDC WONDER.
[3]North Carolina population estimates taken from the July 1 estimates for each year.
[4]1995-1998 deaths adjusted for the ICD-9 to ICD-10 comparability ratio.
[5]Asthma death defined as primary cause of death as asthma (ICD-9 493, ICD-10 J45-J46).
Data Source: CDC Wonder and North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1995-2004

Summary of Figure 46 and Table 21:

- Mortality rates due to asthma have been decreasing in North Carolina from 20.18 per million in 1995 to 13.57 per million in 2005. This decreasing trend is significant (ρ=-0.864, p=0.001).

North Carolina Data

The following tables 22 through 29 demonstrate mortality due to a primary cause of asthma in North Carolina.

Tables 22 and 23 examine mortality due to a primary cause of asthma for each separate year from 2000 through 2005. Table 22 looks at mortality due to a primary cause of asthma separately by age, race, and sex. (For 1999 data, see Appendix C, Table 1.)

Table 22. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Year, Age, Race, and Sex, North Carolina, 2000 – 2005[1,2,3,4]

	2000	2001	2002	2003	2004	2005
	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)
Age						
<5	*	*	(0)	(0)	*	*
5 to 14	*	*	*	*	4.33 (5)	6.83 (8)
15 to 34	3.42 (8)	3.39 (8)	2.51 (6)	2.90 (7)	3.69 (9)	3.66 (9)
35 to 64	7.71 (24)	14.81 (47)	12.68 (41)	13.97 (46)	10.42 (35)	12.21 (42)
65+	74.03 (72)	67.04 (66)	55.33 (55)	49.78 (50)	52.12 (53)	53.18 (55)
Race						
White	12.14 (76)	13.57 (86)	10.71 (69)	10.16 (67)	10.42 (69)	9.43 (64)
Minority	29.57 (49)	29.28 (52)	24.41 (41)	31.59 (55)	24.54 (44)	27.43 (52)
Sex						
Male	13.68 (46)	11.55 (39)	10.30 (37)	12.36 (44)	9.56 (38)	8.24 (32)
Female	17.65 (79)	22.25 (99)	15.84 (73)	16.76 (78)	15.67 (75)	17.48 (84)

*Number of deaths <5 and >0
[1]North Carolina population estimates taken from the July 1 estimates for each year.
[2]Numbers rounded to the nearest hundredth.
[3]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
[4]Minority includes African American, Asian, and American Indian and Alaskan Native.
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2000-2004

Summary of Table 22:

- Between 1999 and 2005, mortality rates for the age group 65 and older decreased from 72.35 per million in 1999 to 53.18 per million in 2005. This decreasing trend is significant (ρ=-0.821, p=0.028).
- Mortality rates due to asthma for age groups 15 to 34 and 35 to 64 remained relatively the same over the seven years from 1999-2005.
- Mortality rates for both whites and minorities showed decreasing trends, however, the decreasing trend for whites was significant for the years 1999-2005 (ρ=-0.857, p=0.019).
- Mortality rates by gender decreased overall in the past seven years, with the decreasing trend for men being significant for the years 1999-2005 (ρ=-0.857, p=0.019).

Table 22 looks at mortality due to a primary cause of asthma by sex and race for each year from 2000 through 2005. (For 1999 data, see Appendix C, Table 2.)

Table 23. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Year, Sex, and Race, All Ages, North Carolina, 2000—2005[1,2,3]

	2000	2001	2002	2003	2004	2005
White Males						
Rate	10.03	7.93	7.19	7.46	5.9	4.4
(95% CI)	(6.6, 14.8)	(4.7, 12.5)	(4.3, 11.2)	(4.5, 11.6)	(3.5, 9.3)	(2.3, 7.6)
Count	27	20	20	20	18	13
White Females						
Rate	13.27	18.05	13.45	12.68	13.33	12.96
(95% CI)	(9.8, 17.6)	(13.9, 23)	(9.9, 17.8)	(9.3, 16.9)	(9.9, 17.6)	(9.6, 17.08)
Count	49	66	49	47	51	51
Minority Males						
Rate	28	27.13	23.23	32.21	23.27	24.1
(95% CI)	(16, 45.5)	(15.8, 43.4)	(13.3, 37.7)	(19.9, 49.2)	(13.6, 37.3)	(13.8, 39.1)
Count	19	19	17	24	20	19
Minority Females						
Rate	31.36	32.25	24.7	31.38	24.07	30.65
(95% CI)	(21, 45)	(22.1, 45.5)	(15.8, 36.8)	(21.3, 44.5)	(15.4, 35.8)	(21.5, 42.4)
Count	30	33	24	31	24	33

Confidence Intervals rounded to nearest tenth
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
[3]Minority includes African American, Asian, and American Indian and Alaskan Native.
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2000-2005

Summary of Table 23:

- Overall, white males had the lowest mortality rates, followed by white females, then minority males. Minority females had the highest mortality rates of these four groups, at more than three times the rate of white males.
- Each year from 1999 through 2005, white males had significantly lower mortality rates than both minority males and minority females.
- Mortality rates for white males from 1999-2005 showed a significant decreasing trend (ρ=-0.929, p=0.006).
- White females had significantly higher mortality rates than white males in 2001, 2004, and 2005.
- Minority males had a significantly higher mortality rate than white females in 2003.
- Minority Females had a significantly higher mortality rate than white females in 1999, 2000, 2003, and 2005.

Because mortality due to a primary cause of asthma is a relatively rare event, it is helpful to combine years of data to get an accurate look at some of the variables that might be factors in asthma related deaths. Tables 24 through 29 review asthma mortality over a six year period, from 1999 through 2005. Mortality rates were developed using the sum of the deaths for the seven years, and the sum of the North Carolina population (for that group) at the mid year point for each year.

Table 24 looks at mortality due to a primary cause of asthma by age group.

Table 24. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Age, North Carolina, 1999-2005[1]

	Rate (Count)	95% CI
Age		
<5	2.03 (8)	0.9-4
5 to 14	3.02 (24)	1.9-4.5
15 to 34	4.37 (73)	3.4-5.5
35 to 64	14.05 (318)	12.3-15.8
65+	62.21 (433)	56.4-68.1

Confidence intervals rounded to nearest tenth
[1]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 24:

- Asthma mortality increases with age.
- The total number of deaths for those under age 65 is 423 and for those 65 and older, it is 433. The majority of deaths occur in those over age 65.

Table 25. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Sex, All Ages, North Carolina, 1999-2005

	Rate (Count)	95% CI
Male	11.15 (278)	9.8-12.5
Female	18.02 (578)	16.6-19.5

Confidence intervals rounded to nearest tenth
[1]Rates are age adjusted to the 2000 U.S. standard population.
[3]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 25:

- Females have a significantly higher mortality rate due to a primary cause of asthma (18.02 deaths per million) than males (11.15 deaths per million).

Table 26. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Sex and Age, North Carolina, 1999-2005[1]

	Rate (Count)	95% CI
Sex and Age		
Male <5	*	*
Male 5 to 14	2.95 (12)	1.5-5.1
Male 15 to 34	4.18 (36)	2.9-5.8
Male 35 to 64	9.22 (102)	7.4-11
Male 65+	43.97 (124)	36.2-51.7
Female <5	*	*
Female 5 to 14	3.1 (12)	1.6-5.4
Female 15 to 34	4.57 (37)	3.2-6.3
Female 35 to 64	18.67 (216)	16.2-21.2
Female 65+	74.64 (309)	66.3-83

*Number of deaths <5 and >0
Confidence intervals rounded to nearest tenth
[1]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 26:

- The data indicates that there is no significant difference in mortality rates between males and females, until the age group of 35 to 64.
- Females have mortality rates twice that of males in the age group 35 to 64, and have a significantly larger mortality rates in the age group 65+ than males.

Table 27. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race, All Ages, North Carolina, 1999-2005[1,2]

	Rate (Count)	95% CI
White	11.21 (505)	10.2-12.2
African Americans	30.39 (333)	27.1-33.7
American Indian or Alaskan Native§	27.9 (13)*	14.5-48.9

*Less than 20 deaths are included in this rate, interpret with caution.
§Based on 1999-2004 numbers
Confidence Intervals rounded to nearest tenth
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 27:

- African Americans have a significantly higher mortality rate (30.39 deaths per million) than whites (11.21 deaths per million).
- There were a total of four deaths due to a primary cause of asthma attributed to persons identified as Asian from 1999-2005, so those numbers were omitted due to the small size.
- There were a total of 13 deaths due to a primary cause of asthma attributed to persons identified as Native American.

In the remainder of data in this section, Native Americans and Asians will be included in the minority group with African Americans.

Table 28. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race and Age, North Carolina, 1999-2005[1]

	Rate (Count)	95% CI
Race and Age		
White <5	*	*
White 5 to 14	1.1 (6)	0.4-2.4
White 15 to 34	2.73 (33)	1.9-3.8
White 35 to 64	8.73 (152)	7.3-10.1
White 65+	54.22 (312)	48.2-60.2
Minority[§] <5	5.12 (6)	1.9-11.1
Minority[§] 5 to 14	7.17 (18)	4.3-11.3
Minority[§] 15 to 34	8.66 (40)	6.2-11.8
Minority[§] 35 to 64	31.79 (166)	27-36.6
Minority[§] 65+	100.35 (121)	82.5-118.2

*Number of deaths <5 and >0
Confidence Intervals rounded to nearest tenth
[§]Minority includes African American, Asian, and American Indian and Alaskan Native.
[1]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 28:

- Mortality rates increase with age in all racial groups.
- Minorities have mortality rates more than three times the mortality rates than whites in each age group up to age 64. In the age group 65+, minorities have a mortality rate almost twice that of whites

Table 29. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race, Sex, and Age, North Carolina, 1999-2005[1]

	Rate (Count)	95% CI
Sex and Race and Age		
White Male <5	*	*
White Male 5 to 14	*	*
White Male 15 to 34	2.52 (16)	1.4-4.1
White Male 35 to 64	4.85 (42)	3.5-6.6
White Male 65+	32.85 (73)	26-41
White Female <5	*	*
White Female 5 to 14	*	*
White Female 15 to 34	2.96 (17)	1.7-4.7
White Female 35 to 64	12.56 (110)	10.3-15.1
White Female 65+	69.23 (234)	60.6-78.7
Minority§ Male <5	*	*
Minority§ Male 5 to 14	7.08 (9)	3.2-13.4
Minority§ Male 15 to 34	8.85 (20)	5.4-13.7
Minority§ Male 35 to 64	24.9 (60)	19-32
Minority§ Male 65+	103.17 (46)	75.5-137.6
Minority§ Female <5	*	*
Minority§ Female 5 to 14	7.26 (9)	3.3-13.8
Minority§ Female 15 to 34	8.46 (20)	5.2-13.0
Minority§ Female 35 to 64	37.7 (106)	31-45.6
Minority§ Female 65+	98.6 (75)	77.6-123.7

*Number of deaths <5 and >0
Confidence Intervals rounded to nearest tenth
§Minority includes African American, Asian, and American Indian and Alaskan Native.
[1]Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 29:

- While the majority of the mortality rates for the age group 15 to 34 are based on less than 20 deaths, the data indicates that minority males and females have significantly higher mortality rates than both white males and white females.
- In the 35 to 64 age group, white females have a significantly higher mortality rate than white males. Minority males and females have significantly higher mortality rates than both white males and white females. Although it is not significant, data

indicates minority females have a higher mortality rate in this age group than minority males.

- For the age group 65+, white females, minority males, and minority females all have mortality rates significantly greater than white males. Although not significant, data indicates that minority males and females have higher mortality rates than white females.
- This data indicates that both racial and gender disparities exist in asthma mortality rates in North Carolina.

Asthma as a Contributory Cause of Death

When looking at cause of death, analysis of the underlying (primary) cause of death allows for simplified, consistent reporting of data and provides a means of evaluating the impact of public health initiatives. However, when more than one cause is reported on a death certificate, the tabulation of only one cause for mortality statistics may lead to a loss of information on any condition that is an element in the death but that is not selected as the underlying cause of death. Death certificates provide for the inclusion of more information than the underlying cause of death alone. The immediate cause of death, antecedent causes giving rise to the immediate cause, and other significant conditions contributing to the death also may be entered by the medical certifier. The data provides a way of estimating the impact of significant co-factors contributing to a death and offer a means of utilizing information on causes, such as hypertension, asthma, bronchitis, and diabetes, that are frequently present at death but that are usually not lethal by themselves. Each death is assigned one underlying cause and up to 19 contributing causes of death.[47]

The North Carolina State Center for Health Statistics provided the information for asthma as a contributory cause of death for this report. Tables 30, 32, and 33 examine asthma as a contributory cause of death for each separate year from 2000 through 2005. Table 31 looks at asthma as a contributory cause of death for the years 1999 through 2005 combined. Similar to the previous section, asthma as a primary cause of death, the rates were developed using the sum of the deaths for the six years, and the sum of the North Carolina population (for that group) at the mid-year point for each year.

Table 30. Mortality Due to a Primary or Contributory Cause of Asthma per 1,000,000 Population, by Year, All Ages, North Carolina, 2000-2005[1,2,3] (For 1999 data, see appendix C, table 3.)

	2000	2001	2002	2003	2004	2005
Primary						
Rate	16.01	17.39	13.54	14.65	13.50	13.57
(95% CI)	(13.2, 18.8)	(14.5, 20.0)	(10.0, 17.08)	(12.0, 17.3)	(11.0, 16.0)	(11.1, 16.0)
Count	125	138	110	122	113	116
Contributory						
Rate	23.96	24.56	21.20	25.92	21.31	24.37
(95% CI)	(20.5, 27.5)	(21.2, 28.0)	(18.0, 24.4)	(22.4, 39.4)	(18.2, 24.4)	(21.0, 27.7)
Count	182	192	171	211	179	209

Confidence Intervals rounded to nearest tenth
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]North Carolina population estimates taken from the July 1 estimates for each year.
[3]Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 30:

- From 2000 through 2005, mortality rates for asthma as a contributory cause of death in North Carolina are significantly higher than mortality rates for asthma as a primary cause of death.

Table 31. Mortality Due to a Primary or Contributory Cause of Asthma per 1,000,000 Population, by Age Group, North Carolina, 1999-2005[1,2,3]

	<5	5 to 14	15 to 34	35 to 64	65+
Primary					
Rate	2.03	3.02	4.37	14.05	62.21
(95% CI)	(0.9, 4)	(1.9, 4.5)	(3.4, 5.5)	(12.3, 15.8)	(56.4, 68.1)
Count	8	24	73	318	433
Contributory					
Rate	3.05	*	1.98	18.69	121.69
(95% CI)	(1.58, 5.33)		(1.6, 2.8)	(16.9, 20.5)	(113.5, 129.9)
Count	12		33	423	720

*Number of deaths <5 and >0.
Confidence Intervals rounded to nearest tenth
[1]Rates developed by using the sum of deaths for 6 years, and the sum of N.C. population at mid year for each year.
[2]Numbers were rounded to the nearest hundredth.
[3]Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics, 1999-2005

Summary for Table 31:

- Mortality rates for asthma as a contributory factor of death increase significantly from age group 15 to 34, to age group 35 to 64, and significantly increase still through the 65+ age group.

- Mortality rates for asthma as a contributory cause of death in age groups 35 and older are significantly higher than mortality rates for asthma as a primary (underlying) cause of death.

Table 32. Mortality Due to a Contributory Cause of Asthma per 1,000,000 Population, by Sex and Year, All Ages, North Carolina, 2000-2005[1,2,3]
(For 1999 data, see Appendix C, Table 4.)

	2000	2001	2002	2003	2004	2005
Males						
Rate	19.54	18.44	14.36	21.65	14.94	17.37
(95% CI)	(14.7, 25.5)	(13.9, 24)	(10.3, 19.5)	(16.7, 27.5)	(11, 19.8)	(13.2, 22.7)
Count	59	58	44	71	51	64
Females						
Rate	26.79	28.81	27.10	29.50	26.29	29.02
(95% CI)	(22, 31.5)	(23.9, 33.7)	(22.4, 31.8)	(24.6, 34.4)	(21.7, 30.9)	(24.3, 33.8)
Count	123	134	127	140	128	145

Confidence Intervals rounded to nearest tenth
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]North Carolina population estimates taken from the July 1 estimates for each year.
[3]Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 32:

- Females tend to have a higher rate of asthma as a contributory cause of death than males (similar to the results seen with asthma as a primary cause of death). The difference is significant for females having a higher rate of asthma as a contributory cause of death in 1999, 2002, 2004, and 2005.

Table 33. Mortality Due to a Contributory Cause of Asthma per 1,000,000 Population, by Race and Year, All Ages, North Carolina, 2000-2005[1,2]
(For 1999 data, see appendix C, table 5.)

	2000	2001	2002	2003	2004	2005
Whites						
Rate	22.69	21.06	17.55	20.58	19.33	19.02
(95% CI)	(18.9, 26.5)	(17.5, 24.7)	(14.3, 20.8)	(17.1, 24.1)	(16, 22.7)	(15.8, 22.3)
Count	140	132	114	135	131	131
Minorities[§]						
Rate	28.59	39.61	35.94	46.43	28.62	45.64
(95% CI)	(20.4, 38.9)	(30.1, 51.2)	(27.1, 46.8)	(36.4, 58.4)	(21, 38.2)	(35.8, 57.3)
Count	42	60	57	76	48	78

[§]Minority includes African American, Asian, and American Indian and Alaskan Native.
[1]Rates are age adjusted to the 2000 U.S. standard population.
[2]North Carolina population estimates taken from the July 1 estimates for each year.
[3]Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 33:

- Minorities have had a higher rate of asthma as a contributory cause of death than whites each year for the past six years, with that rate being significant in 1999, 2001, 2002, and 2003.

Key Findings From This Chapter

- In North Carolina in 2005, females have a significantly higher mortality rate (17.48 per 1,000,000) due to a primary cause of asthma than males (8.24 per 1,000,000). This data is consistent with previous years.
- Over the previous six years, African American's mortality rate due to asthma (30.39 deaths per million) is significantly higher than the mortality rate due to asthma for whites (11.21 deaths per million).
- Native Americans have a mortality rate due to asthma from 1999 to 2004 (2005 census data not yet available) of 27.9 per 1,000,000. This number is similar to the mortality rate for other minorities in North Carolina, and significantly greater than the white mortality rate due to asthma. However, this mortality rate is based on a small number of deaths (13), and therefore should be interpreted with caution.